

ABSTRACT

Lithographic Apparatus and Device Manufacturing Method

A lithographic apparatus and device manufacturing method makes use of a high refractive index liquid confined in a reservoir 13 at least partly filling the imaging field between the final element of the projection lens and the substrate. Bubbles forming in the liquid from dissolved atmospheric gases or from out-gassing from apparatus elements exposed to the liquid are detected and removed so that they do not interfere with exposure and lead to printing defects on the substrate. Detection can be carried out by measuring the frequency dependence of ultrasonic attenuation in the liquid and bubble removal can be implemented by degassing and pressurizing the liquid, isolating the liquid from the atmosphere, using liquids of low surface tension, providing a continuous flow of liquid through the imaging field, and phase shifting ultrasonic standing-wave node patterns.

Fig. 4.